REMARKS

Present Status of the Application

The Office Action rejected all pending claims 1-4 and 7-18. Specifically, claims 1-2 were rejected under 35 U.S.C. 102(b) as being anticipated by Shimada et al (US 4,161,645, US645). Claims 3-4 and 7-18 (Applicants believe that Examiner had mistyped the claim numbers as "5-18" in Point 5 of the Office Action) were rejected under 35 U.S.C. 103(a) as being unpatentable over US645 in view of JP 2003-019561 (JP561).

In response thereto, Applicants have amended claims 1-2 and submitted the following remarks. Claim 17 has also been amended, and the amendment can be supported by FIG. 1. Reconsideration of claims 1-4 and 7-18 is respectfully requested for the reasons set forth.

Discussion of Rejections to Claims 1-2 under 35 U.S.C. 102(b)

Claims 1-2 were rejected as being anticipated by US645. Please note that Applicants have amended claims 1-2 by replacing the words "can be" with the word "is".

One feature of amended claim 1 (or 2) is that a second shielding gas containing an oxidative gas ***is*** supplied between the inner nozzle and the outer nozzle (or from the side nozzles), wherein the concentration of the oxidative gas in the second shielding gas ranges from 2000 vol. ppm to 6000 vol. ppm.

US645 fails to disclose the feature, because no preferred range of the oxidative gas concentration is mentioned in US645 and the lowest concentration of oxidative gas (CO_2) in the second shielding gas set in the experiments of US645 is about 35% (Fig. 8), ***which is much higher than 2000-6000 vol. ppm***. US645 ***does not*** supply a second shielding gas

containing an oxidative gas in a concentration of 2000-6000 vol. ppm, though the structure of US645's welding apparatus allows such a second shielding gas to be supplied.

For at least the above reasons, Applicants respectfully submit that amended claims 1-2 patently define over the prior art under 35 U.S.C. 102(b).

Discussions of Rejections under 35 U.S.C 103(a) and Non-obviousness of Claims 1-2

Claims 3-4 and 7-18 were rejected under 35 U.S.C. 103(a) as being unpatentable over US645 in view of JP561. Equipment claims 1 and 2 respectively corresponding to method claims 3 and 4 are also discussed below for their non-obviousness.

A common feature of claims 1-4 is that a second shielding gas containing an oxidative gas is supplied from an outer side, wherein the concentration of the oxidative gas in the second shielding gas ranges from 2000 vol. ppm to 6000 vol. ppm.

Examiner stated in Page 4 that "*it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to have oxygen content between 1000 to 4000 ppm as taught by JP'561, in Shimada et al, in order enhance workability*". However, Applicants respectfully submit that the above feature of claim 1-4 cannot be obtained from the combination of US645 and JP561 for the reasons set forth.

As described in the Abstract, Claims and Specification, JP561 uses only one shielding gas obtained by mixing a conventional shielding gas of Ar or He with oxygen gas in a concentration of 1000-4000 ppm. Thus, the shielding gas used in JP561 surely directly surrounds the electrode and hence ***corresponds to the first shielding gas in US645 or this invention***. Since there is no teaching or suggestion in US645 and JP561 that an Ar- or He-based shielding gas containing oxygen gas in a concentration of 1000-4000 ppm can be used

as an outer shielding gas (= a second shielding gas supplied from an outer side), when one of ordinary skill combines US645 with JP561, he/she will naturally ***only replace the first shielding gas*** in US645 with the shielding gas of JP561 but ***not replace the second shielding gas*** in US645 with the same.

That is, in the derivative method as the combination of US645 and JP561, the first shielding gas is an Ar or He gas containing O_2 in a concentration of 1000-4000 ppm and the second shielding gas has a high oxidative gas concentration of at least about 35%. ***This is surely not the case of claims 1-4*** where the first shielding gas is an inert gas and the second shielding gas contains an oxidative gas in a concentration of 2000-6000ppm.

Moreover, because the first (= inner) shielding gas directly surrounding the electrode contains O_2 in the derivative method as the combination of US645 and JP561, ***the electrode is consumed much more rapidly with time*** as compared with the case of this invention where the first (= inner) shielding gas is an inert gas. Thus, the effect of this invention is better than that of the derivative method as the combination of US645 and JP561.

For at least the above reasons, Applicants respectfully submit that independent claims 1-4 patently define over the prior art.

For at least the same reasons mentioned above, Applicants respectfully submit that claims 7-16 dependent directly or indirectly from claims 3-4 also patently define over the prior art.

As for claim 18, Examiner stated in Page 4 that "*the length of side nozzle shorter or longer than the central tube would depend on control of the oxygen gas*", but Applicants respectfully point out that the reason for the feature of claim 18 is not so simple.

Specifically, forming the tips of the side nozzles more protrudent than the tip of the central nozzle makes the second shielding gas blow the welded metal portion only ***without affecting the arc*** (see FIG. 3(a), for example) to induce convection in the welded metal portion for a deep penetration (see FIG. 2(b), for example). On the contrary, US645 ***intends to restrict and constrict the radial extent of the arc (4)*** by means of the thermal pinch effect (col. 4, lines 12-15), so that the side nozzles are tapered inwardly and a projection is formed on the internal wall of the central nozzle near the tip thereof in US645 making the second shielding gas (7) surround the arc (4) to cool the outer portion of the same (see FIG. 5(a)/(b) and FIG. 6). On the other hand, the welding apparatus of JP561 has only one nozzle that directly surrounds the electrode without any side nozzle.

For at least the same reasons applied to independent claim 2 and the above reasons, Applicants respectfully submit that claim 18 dependent from claim 2 also patently defines over the prior art.

For currently amended claim 17, the feature that the tip of the tubular inner nozzle is more protrudent than that of the tubular outer nozzle also has the effect of the above feature of claim 18. Specifically, forming the tip of the inner nozzle more protrudent than that of the outer nozzle makes the second shielding gas blow the welded metal portion only ***without affecting the arc*** (see FIG. 1, for example) to induce convection in the welded metal portion for a deep penetration (see FIG. 2(b), for example). On the contrary, US645 ***intends to restrict and constrict the radial extent of the arc (4)*** by means of the thermal pinch effect (col. 4, lines 12-15), so that the side nozzles are tapered inwardly and a projection is formed on the internal wall of the central nozzle near the tip thereof in US645 making the second shielding gas (7) surround the arc (4) to cool the outer portion of the same (see FIG. 5(a)/(b) and FIG. 6).

On the other hand, the welding apparatus of JP561 has only one nozzle that directly surrounds the electrode without any side nozzle.

For at least the same reasons applied to independent claim 1 and the above reasons, Applicants respectfully submit that claim 17 dependent from claim 1 also patently defines over the prior art.

CONCLUSION

For at least the foregoing reasons, it is believed that pending claims 1-4 and 7-18 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,
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Date: 4/27/2006

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